SPACER FOR MATERIAL HANDLING INDUSTRY AND METHOD AND ASSEMBLY FOR FORMING SAME

CROSS-REFERENCE

This patent application claims the benefit of domestic priority of United States Provisional Application Serial No. 60/427,492, filed November 19, 2002, and entitled "Support For Stacked Panels".

BACKGROUND OF THE INVENTION

The present invention relates to a support for stacked panels, such as masonite or gypsum wallboards. More specifically, the present invention relates to a spacer used in the shipment of stacks of wallboard panels. While the invention will be described and illustrated with regard to stacked wallboard panels, the spacer of the present invention may be used as a spacer for other flat or panel-like products, such as plywood, etc., that are stored and/or transported in a stacked configuration or array.

Wallboards, such as gypsum wallboards, are typically stacked into bundles or lifts, stored, and then transported, and again stored at a wholesale, retail site, or even at a job site. During the stacking, storing and transporting of the lifts, the lifts must be supported and separated by a spacer, or, as they are commonly referred to in the industry, a slooter, in order to allow forklifts to easily be positioned under each lift to allow for the forklift to pick up and

move the lifts of wallboard.

A lift is generally comprised of 30 to 36 wallboards which are stacked one on top of the other. Each wallboard in a lift is typically four (4) feet wide by eight (8) feet long and typically weighs between 50 and 55 pounds. Thus, one lift may generally weigh anywhere from 1,500 pounds to 2,000 pounds. Of course, the size, and thus the weight, of each wallboard may vary, as ten (10) feet by twelve (12) feet sections are not uncommon.

Within a warehouse, lifts are typically stacked ten (10) high, while on a flatbed truck, lifts are typically stacked three (3) high. Thus, in order for a forklift to be able to pick up and move a lift, the lifts that are stacked on top of each other must be spaced from one another by a spacer or a slooter. As illustrated in FIGURES 1A and 1B, four slooters 20 are typically used to support and space every four (4) foot by eight (8) foot lift 22. Of course the number of slooters 20 used may be changed depending on the size of the wallboards 24. The four slooters 20 must also be formed to be strong enough to support the 1,500 to 2,000 pounds of each lift 22, along with the 15,000 to 20,000 pounds associated with ten lifts 22.

As illustrated in FIGURES 1A and 1B, present practice is to create a slooter 20 which is formed of a number of stacked layers of wallboard which have been laminated together. The laminated layers of wallboard are then typically sawed into strips which are approximately three (3) inches wide. The layers of wallboard are typically formed from either defective wallboard or existing wallboard. If defective wallboard is used to form the slooters 20, extra time and cost must be put in to determine which wallboards are defective and available for use in forming the slooters 20. These slooters 20 have been used for the past 50 years to ship wallboard. The use of slooters 20 created from defective or existing wallboard has a number of associated disadvantages. No other suitable replacement has been provided in these 50 years which overcomes each of these disadvantages.

One disadvantage of using wallboard, such as gypsum wallboard, for slooters is that the formation of wallboard is expensive and, thus, every time a manufacturer uses wallboard to form a slooter, the manufacturer of the wallboard will not reap a return on the wallboard used for the formation of the slooters. It is also disadvantageous for a manufacturer to use good wallboard in order to make a slooter 20 which is a waste product. Obviously, the expense would be less to the manufacturer if the slooters were brought back to the gypsum plant and recycled or reused. But, currently there is not a good infrastructure or incentive in place to return all slooters to the gypsum plant and, thus, there are major and significant disposal, freight and sortation costs to consider. Further, if slooters were shipped back to the gypsum plant, the slooters are not easily stackable. The slooters would also have to strapped down on or within a truck and such a process would require added labor to gather and unitize the slooters.

Thus, because gypsum slooters are not typically recycled or reused, the slooters must be sent to and dumped at a landfill as gypsum slooters cannot be burned, or the slooters are generally buried in a yard or in the walls of a house by the end user. The problem with dumping these slooters at a landfill is the associated costs, as well as the obvious effect the slooters have on the environment and the ever-declining number of landfills as they begin to fill. It is estimated that the total gypsum industry slooter usage is 152 million pieces per year. With each slooter weighing 9-13 pounds, approximately 684,000 to 988,000 tons of gypsum waste is created from gypsum slooters each year. Typical landfill tipping fees are $35.00 per ton, which comes to a $23.94 million dollars to $34.58 million dollars in consumer land fill tipping fees for fifty years.

Another disadvantage of using wallboard, such as gypsum wallboard, is that gypsum slooters are extremely distasteful to retailers, and also homeowners, because of the mess and

serious safety hazard caused by the gypsum dust and excessive weight. Retailers who purchase gypsum wallboards typically have landfill charges of over a million dollars per year, not to mention the cleanup and preparation costs associated with gypsum spacers, as well as the labor and pallet costs associated with shipping the gypsum slooters to the landfill.

A third disadvantage of gypsum slooters is that they are heavy, typically 9 to 13 pounds apiece. A typical shipment of wallboard on a flatbed truck generally includes 26 lifts, each of which weigh approximately 1,700 pounds, for a total weight of approximately 44,200 pounds. As four slooters are typically used for each lift, 104 slooters must then be used in the shipment of wallboard on a flatbed truck. As each slooter weighs 9 to 13 pounds, an extra 936 to 1,352 pounds per truckload is added by the use of gypsum slooters. As truckloads are limited in weight based on the amount the truck can carry and/or the amount which the truck is allowed to carry on the roads, the amount of wallboards which the truck can carry is limited by the heavy slooters. Thus, over a thousand pounds of the tare weight is taken up by the gypsum slooters.

It should be noted that slooters may also be formed from scrap or new lumber, such as two by fours. The use of lumber for slooters suffers from many of the same disadvantages as are associated with wallboard spacers, such as the lumber being expensive, the lumber generally not being recycled or reused, and being heavy.

Thus, there is a need for a spacer capable of handling the weight requirements of the lifts, but which also overcomes the disadvantages of the prior art slooters. The present invention provides a new and novel designs for a spacer and methods and apparatuses for manufacturing same.

OBJECTS AND SUMMARY OF THE INVENTION

A primary object of an embodiment of the present invention is to provide a spacer, and a method of manufacturing same, which is lighter than spacers of the prior art, but which is capable of supporting the weight of single lift or multiple lifts of wallboard in either a warehouse or on a truck.

Another primary object of an embodiment of the present invention is to provide a spacer, and a method of manufacturing same, which is easily recyclable and which is capable of supporting the maximum weight of multiple lifts of wallboard.

Yet another primary object of an embodiment of the present invention is to provide a spacer, and a method of manufacturing same, which is generally clean and dust free, but which is capable of supporting the maximum weight of multiple lifts of wallboard.

An object of an embodiment of the present invention is to provide a spacer, and a method of manufacturing same, which does not require the use of expensive gypsum wallboard or expensive lumber.

Another object of an embodiment of the present invention is to provide a spacer, and a method of manufacturing same, which allows for the spacers to be nested or stacked, one on top of the other, such that in transportation of the spacers, thousands of spacers may be shipped to reduce freight costs.

Still another object of an embodiment of the present invention is to provide a spacer, and a method of manufacturing same, which is recyclable.

Yet another object of an embodiment of the present invention is to provide a spacer, and a method of manufacturing same, which is capable of saving the manufacturers and retailers of gypsum wallboards millions of dollars in associated transportation and disposal costs per year.

Another object of an embodiment of the present invention is to provide a spacer, and a method of manufacturing same, which allows for the transportation of more lifts of wallboard per truckload than do spacers of the prior art.

Yet another object of an embodiment of the present invention is to provide a spacer which has a width which provides a surface such that material can be stacked on the surface.

Still another object of an embodiment of the present invention is to provide a spacer which has a curved wall as opposed to a straight wall such that the spacer is strong and stable.

Another object of an embodiment of the present invention is to provide a spacer which is configured to stand by itself and which is very economical to manufacture.

Briefly, and in accordance with the foregoing, the present invention provides a spacer which is formed of a paper product and which has been formed into a waved configuration. Each paper spacer weighs approximately one (1) to two (2) pounds and has a compression safety factor of at least four times the dead weight amount which it is to support in a warehouse or truck shipment in order to account for environmental loss common with a paper product. The laminated paper spacers are nestable or stackable on one another. The paper spacers are formed by laminating a plurality of layers of paper product to produce a formed sheet. The sheet is then engaged with or formed by a die station which would produce the wave form configuration. The wave formed sheet would then be cut into sections to provide the desired height for the spacers. Also, the paper grain fiber orientation is aligned in a specific manner to optimize the performance of the spacer such that the desired supportive strength of the spacer is achieved.

BRIEF DESCRIPTION OF THE DRAWINGS

The organization and manner of the structure and operation of the invention, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings wherein like reference numerals identify like elements in which:

FIGURE 1A is a side elevational view of lifts of wallboards stacked one on top of another, the lifts of wallboards being separated and supported by prior art types of slooters, namely slooters formed from wallboard;

FIGURE 1B is a front elevational view of lifts of wallboards stacked one on top of another, the lifts of wallboards being separated and supported by prior art types of slooters, namely slooters formed from wallboard;

FIGURE 2 is a flow chart of the first preferred embodiment of the method of forming the spacer of the first preferred embodiment of the invention;

FIGURE 3 is a top plan view of a floor of a manufacturing plant which includes the first preferred embodiment of the assembly used for forming the spacer of the first embodiment of the invention;

FIGURE 4 is a flow chart of the sub-steps of one of the steps illustrated in FIGURE 2;

FIGURE 5 is a perspective view of the first preferred embodiment of the assembly used for forming the spacer of the first embodiment of the invention;

FIGURE 6 is a top plan view of the assembly illustrated in FIGURE 5;

FIGURE 7 is a cross-sectional view of the assembly of FIGURE 6 taken along line 7-7;

FIGURE 8 is a cross-sectional view of the assembly of FIGURE 6 taken along line 8-8;

FIGURE 9 is the assembly of FIGURE 5 with a stack of sheets entering the assembly;

FIGURE 10 is the assembly of FIGURE 5 with a finished wave-like product exiting the assembly;

FIGURE 11 is a flow chart of the second preferred embodiment of the method of forming the spacer of the first embodiment of the invention;

FIGURE 12 is a top plan view of a floor of a manufacturing plant which includes the second preferred embodiment of the assembly used for forming the spacer of the first embodiment of the invention;

FIGURE 13 is a side plan view of the second preferred embodiment of the assembly used for forming the spacer of the first embodiment of the invention;

FIGURE 13a is an exploded side plan view of the assembly illustrated in FIGURE 13 taken from circle 13a;

FIGURE 13b is an exploded side plan view of the assembly illustrated in FIGURE 13 taken from circle 13b;

FIGURE 14 is a flow chart of the sub-steps of one of the steps illustrated in FIGURE 12;

FIGURE 15 is a flow chart of the sub-steps of one of the sub-steps illustrated in FIGURE 14;

FIGURE 16 is a flow chart of the third preferred embodiment of the method of forming the spacer of the first embodiment of the invention;

FIGURE 17 is a side plan view of a third preferred embodiment of an assembly for forming the spacer of the first embodiment of the invention;

FIGURE 18 is a perspective view of the die station of the assembly illustrated in FIGURE 17;

FIGURE 19 is a perspective view of the spacer of the first embodiment of the invention;

FIGURE 19a is a partial perspective view of an alternative spacer of the first embodiment of the invention;

FIGURE 20 is a perspective view of the spacer of the first embodiment of the invention, shown partially in phantom line, separating a pair of lifts, shown partially broken-away, and supporting one of the lifts above the other lift;

FIGURE 21 is a side plan view of a plurality of lifts being supported and spaced by the spacers of the first embodiment of the invention;

FIGURE 22 is a flow chart of the first preferred embodiment of the method of forming the spacer of the second preferred embodiment of the invention;

FIGURE 23 is a flow chart of the second preferred embodiment of the method of forming the spacer of the second preferred embodiment of the invention;

FIGURE 24 is a flow chart of the third preferred embodiment of the method of forming the spacer of the second preferred embodiment of the invention;

FIGURE 25 is a perspective view of the spacer of the second embodiment of the invention;

FIGURE 25a is a partial perspective view of an alternative spacer of the second embodiment of the invention;

FIGURE 26 is a perspective view of the spacer of the second embodiment of the invention, separating a pair of lifts, shown partially broken-away and shown partially in phantom line, and supporting one of the lifts above the other lift; and

FIGURE 27 is a side plan view of a plurality of lifts being supported and spaced by the spacers of the second embodiment of the invention.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

While this invention may be susceptible to embodiment in different forms, there is shown in the drawings and will be described herein in detail, specific embodiments with the understanding that the present disclosure is to be considered an exemplification of the principles of the invention, and is not intended to limit the invention to that as illustrated, or to the use of the novel spacer construction with wallboard.

A spacer 100 of a first embodiment of the present invention is best illustrated in FIGS. 19-21. A spacer 300 of a second embodiment of the present invention is best illustrated in FIGS. 25-27.

Attention is directed to the spacer 100 of the first embodiment of the present invention, which is illustrated in FIGS. 19-21. The spacer 100 is formed in a first preferred embodiment by the method 102 and assembly 104 illustrated in FIGS. 2-10. The spacer 100 may also be formed in a second preferred embodiment by the method 170 and assembly 172 illustrated in FIGS. 11-15. The spacer 100 may also be formed in a third preferred embodiment by the method 220 and assembly 222 illustrated in FIGS. 16-18.

Attention is directed to FIGS. 2-10 which illustrate the first preferred embodiment of the method 102 and assembly 104 of forming the spacer 100 of the first embodiment of the invention. FIG. 3 illustrates a floor 101 of a manufacturing plant which includes the assembly 104 for forming the spacer 100.

The method 102 of forming the spacer 100 is illustrated in FIG. 2 and begins with the step 106 of providing a number of linerboard rolls 108 with continuous paperboard 110 wrapped therearound. Each linerboard roll 108 typically has two (2) tons of continuous paperboard 110 wrapped therearound. The paperboard 110 wrapped around the linerboard roll 108 typically is eighty (80) inches wide and is typically heavy-weight kraft linerboard.

The method 102 of forming the spacer 100 includes the step 112 of cutting the paperboard 110 into sheets 114 which are preferably forty-eight (48) inches wide by eighty (80) inches long.

The method 102 of forming the spacer 100 includes the step 116 of forming a stack of sheets 118 which are bonded together by an adhesive. The step 116 preferably includes the sub-step 120 of applying an adhesive to the top surface of one of the sheets 114; the sub-step 122 of positioning another one of the sheets 114 on top of the other sheet 114 such that the adhesive is provided between the two sheets 114; and the sub-step 123 of repeating the sub-steps 120, 122 as desired, preferably until the stack of sheets 118 includes eight (8) sheets 114 which are bonded together by seven (7) layers of adhesive, as illustrated in FIG. 4. Of course, the stack of sheets 118 could have any number of sheets bonded together with one less layer of adhesive, depending upon the desired rigidity of the spacer 100 to be formed. The adhesive is preferably applied across the entire top surface of each sheet 114, except, of course, for the last and top sheet 114 of the stack of sheets 118.

The method 102 of forming the spacer 100 includes the step 124 of laminating or forming a finished wave-like product 128 with the assembly 104 by sending the stack of sheets 118 through the assembly 104. Prior to the stack of sheets 118 moving through the assembly 104, the stack of sheets 118 typically have dimensions of eighty (80) inches long by forty-eight (48) inches wide by one-quarter (0.25) of an inch high. Once the stack of sheets 118 is moved through the assembly 104, the resultant finished wave-like product 128 typically has dimensions of forty-eight (48) inches long by forty-eight (48) inches wide by four (4) inches high.

The assembly 104 is best illustrated in FIGS. 5-10. The assembly 104 includes a first end 130 and a second end 132. The first end 130 has a pair of base members 134, 136. The

first end 130 has a pair of shafts 138, 140 which extend between the base members 134, 136. The shaft 138 is positioned above the shaft 140, preferably by a predetermined distance Y. The shafts 138, 140 are rotated by appropriate means known in the art (not shown). The shafts 138 preferably has eight (8) pulleys or discs 142 mounted thereon which rotate with the rotation of the shaft 138. Each pulley 142 is separated from an adjacent pulley 142 by a predetermined distance D. The shaft 140 preferably has nine (9) pulleys or discs 144 mounted thereon which rotate with the rotation of the shaft 140. Each pulley 144 is separated from an adjacent pulley 144 by the predetermined distance D. The pulleys 142 are offset from the pulleys 144 such that each pulley 142 is preferably provided equidistantly between a pair of adjacent pulleys 144.

The second end 132 has a pair of base members 146, 148. The second end 132 has a pair of shafts 150, 152 which extend between the base members 146, 148. The shafts 150 is positioned above the shafts 152, preferably by the predetermined distance Y. The shafts 150, 152 are rotated by appropriate means known in the art (not shown). The shaft 150 preferably has eight (8) pulleys or discs 154 mounted thereon which rotate with the rotation of the shaft 150. Each pulley 154 is separated from an adjacent pulley 154 by a predetermined distance J, which is less than the predetermined distance D between adjacent pulleys 142. The shaft 152 preferably has nine (9) pulleys or discs 156 mounted thereon which rotate with the rotation of the shaft 152. Each pulley 156 is separated from an adjacent pulley 156 by the predetermined distance J. The pulleys 154 are offset from the pulleys 156 such that each pulley 154 is preferably provided equidistantly between a pair of adjacent pulleys 156. The pulleys 154, 156 preferably have a diameter which is larger than a diameter of the pulleys 142, 144.

The assembly 104 preferably has a plurality of cables 158, with each cable 158 wrapping around one of the pulleys 142 at the first end 130 and one of the pulleys 154 at the

second end 132. The assembly 104 preferably also has a plurality of cables 160, with each cable 160 wrapping around one of the pulleys 144 at the first end 130 and one of the pulleys 156 at the second end 132.

The assembly 104 forms the stack of sheets 118 into the wave-like product 128 by inserting the stack of sheets 118 between the cables 158, 160 and pulleys 142, 144 at the first end 130 of the assembly 104, as illustrated in FIG. 9. The rotation of the pulleys 142, 144 rotates the cables 158, 160 such that the stack of sheets 118 will be pulled toward the second end 132 of the assembly 104, all the while forming the stack of sheets 118 into the wave-like product 128 because of the cables 158, 160 moving closer to one another vertically proximate to the second end 132 of the forming apparatus 126 due to the enlarged pulleys 154, 156 at the second end 132, and because of the cables 158, 160 moving closer to one another horizontally proximate to the second end 132 of the assembly 104. Thus, the wave-like product 128 exits from the assembly 104 at the second end 132 thereof, as illustrated in FIG. 10.

The assembly 104 thus stretches, morphs and forms the stack of sheets 118 both upwardly because of the positioning of the cables 158, 160 and downwardly because of the positioning of the cables 158, 160 in order to form the wave-like product 128. The stack of sheets 118 with the layers of adhesive therein is also preferably not pressed prior to entering the assembly 104 because it is desirable to allow the stack of sheets 118 to find its own place during the movement through the assembly 104.

It should be noted that the cables 158, 160 could move closer to one another vertically proximate to the second end 132 could also be achieved by reducing the distance Y between the shafts 138, 140 or the shafts 150, 152, rather than increasing the size of the pulleys 154, 156, or by any combination thereof.

The method 102 of forming the spacer 100 includes the step 162 of allowing the wave-like product 128 to cure for a predetermined time period. The curing of the wave-like product 128 allows the adhesive to stabilize the sheets 114 of paperboard 110 into the wave-like product 128 which was formed by the assembly 104. Preferably, the wave-like product 128 is allowed to cure for a time period of twenty-four (24) hours.

The method 102 of forming the spacer 100 includes the step 164 of cutting the wave-like product 128 into a plurality of spacers 100. The wave-like product 128 is preferably cut such that each spacer 100 has a length L of approximately forty-eight (48) inches, a width W of approximately two and a half (2.5) inches, a height H of approximately four (4) inches, and a thickness T of approximately one-quarter (0.25) of an inch.

The method 102 of forming the spacer 100 may also include the step 166 of stacking a plurality of the wave-like products 128 on top of each other until the stacked plurality of wave-like products 128 reaches a predetermined height of, for instance, fifty (50) inches, prior to the step 162 of allowing the wave-like products 128 to cure for the predetermined time period. Such a stacking would thus allow approximately a few hundred of the wave-like products 128 to be stacked on top of each other as the thickness T of each wave-like product 128 is approximately one-quarter (0.25) of an inch.

The method 102 of forming the spacer 100 may then further include the step 168 of unstacking the plurality of the wave-like products 128 after the step 162 of allowing the wave-like products 128 to cure, but before the step 164 of cutting the wave-like products 128 into the plurality of spacers 100.

Once the spacers 100 are formed by the method 162, the spacers 100 may be stacked/nested as desired and strapped together for shipping.

Attention is directed to FIGS. 11-15 which illustrate the second preferred embodiment

of the method 170 and assembly 172 of forming the spacer 100 of the first embodiment of the invention. FIG. 12 illustrates a floor 169 of a manufacturing plant which includes the assembly 172 for forming the spacer 100.

The second preferred embodiment of the method 170 of forming the spacer 100 is identical to the first preferred embodiment of the method 102 of forming the spacer 100, in that it includes the steps 106, 112, 162, 164, and, if desired steps 166 and 168. Therefore, the description of 112, 162, 164, 166 and 168 will not be repeated herein for brevity purposes. The method 170 does not include the step 116, and step 124 has been changed to step 174, which will be described herein.

In place of the step 124, the second preferred embodiment of the method 170 of forming the spacer 100 includes the step 174, which is the step of forming the finished wave-like product 128 with the assembly 172.

The assembly 172 is best illustrated in FIGS. 12 and 13 and includes a plurality of hoppers 176, preferably eight (8), which are identified as 176a-176h, and which are configured to store and feed the sheets 114 cut during the step 112 of the method 170. Each hopper 176a - 176h is positioned one in front of the other such that the hoppers 176a - 176h are generally in a line. Each of the hoppers 176a - 176h in the line, except for the first hopper 176a, has an adhesive applier (not shown) associated therewith. The assembly 172 further includes a conveying and forming system 178 which includes a first conveyor 180 followed by a plurality of forming conveyors 182, preferably seven (7), which are identified as 182a-182g, and which are positioned one in front of the other. Each forming conveyor 182a - 182g includes an upper die conveyor 184 and a lower die conveyor 186.

The upper die conveyor 184 is a rotatable elongated conveyor which has along its outer surface 188 a continuous die 190 which is preferably molded to form a plurality of

curved peak portions 192 and a plurality of curved valley portions 194 which are alternated along the outer surface 188 of the upper die conveyor 184. The continuous die 190 is configured to rotate around the outer surface 188 of the upper die conveyor 184.

Likewise, the lower die conveyor 186 is a rotatable elongated conveyor which has along its outer surface 196 a continuous die 198 which is preferably molded to form a plurality of curved peak portions 200 and a plurality of curved valley portions 202 which are alternated along the outer surface 196 of the lower die conveyor 186. The continuous die 198 is configured to rotate around the outer surface 196 of the lower die conveyor 186.

As best illustrated in FIG. 13b, each upper die conveyor 184 is positioned above one of the lower die conveyors 186 such that one of the curved peak portions 192 of the continuous die 190 of the upper die conveyor 184 is positioned directly above one of the curved valley portions 202 of the continuous die 198 of the lower die conveyor 186, and such that one of the curved valley portions 194 of the continuous die 190 of the upper die conveyor 184 is positioned directly above one of the curved peak portions 200 of the continuous die 198 of the lower die conveyor 186. Further, the continuous die 190 of the upper die conveyor 184 is configured to rotate counterclockwise while the continuous die 198 of the lower die conveyor 186 is configured to rotate clockwise, for reasons which will be discussed further herein.

The step 174 of forming the finished wave-like product 128 includes the sub-step 204 of removing one of the sheets 114 of paperboard 110 from the first hopper 176a, which does not have an adhesive applier associated therewith, as illustrated in FIG. 14.

The step 174 of forming the wave-like product 128 further includes the sub-step 206 of placing the removed sheet 114 of paperboard 110 onto the first conveyor 180, preferably lengthwise, such that the first conveyor 180 moves the removed sheet 114 of paperboard 110

toward the first forming conveyor 182a.

The step 174 of forming the finished wave-like product 128 further includes the sub-step 208 of removing one of the sheets 114 of paperboard 110 from the next hopper 176b in line.

The step 174 of forming the finished wave-like product 128 further includes the sub-step 210 of applying an adhesive to a lower surface of the sheet 114 of paperboard 110 which was removed from the next hopper 176b in line. Preferably, the adhesive is applied to the entire lower surface of the sheet 114 of paperboard 110.

The step 174 of forming the finished wave-like product 128 further includes the sub-step 212 of bringing together the removed sheet 114 of paperboard 110 from the first hopper 176a with the removed sheet 114 of paperboard 110 from the next hopper 176b in line, such that the lower surface of the sheet 114 from the next hopper 176b in line, which has the adhesive applied thereto, comes into contact with the upper surface of the sheet 114 from the first hopper 176a.

The step 174 of forming the finished wave-like product 128 further includes the sub-step 214 of forming a first wave-like product 216 from the sheets 114 from the first and second hoppers 176a, 176b. The sub-step 214 is formed by the sub-step 217 of submitting the sheets 114 from the hoppers 176a, 176b into the first forming conveyor 182a between the upper and lower die conveyors 184, 186; and the sub-step 219 of moving the sheets 114 through the first forming conveyor 182a toward the second forming conveyor 182b to mold the sheets 114 into the first wave-like product 216, as illustrated in FIG. 15. The sheets 114 are moved from the first forming conveyor 182a to the second forming conveyor 182b because the upper and lower die conveyors 184, 186 rotate in opposite directions. Simultaneously, the sheets 114 are pulled through the first forming conveyor 182a, the sheets

114 are formed into the first wave-like product 216 because of the continuous dies 190, 198 of the upper and lower die conveyors 184, 186 which each have the curved peak portions 192, 200 and the curved valley portions 194, 202 provided on the outer surfaces 188, 196 thereof.

The step 174 of forming the finished wave-like product 128 includes the sub-step 218 of repeating the sub-steps 208, 210, 212 and 214 until the finished wave-like product 128 is formed, such that the finished wave-like product 128 has the desired number of layers of sheets, preferably eight (8), and the desired number of layers of adhesive, preferably seven (7). Thus, once the first wave-like product 216 is formed, a sheet 114 from the next hopper 176c in line, with adhesive applied to a lower surface thereof, is moved through the second forming conveyor 182b with the first wave-like product 216, such that a second wave-like product 220 is formed which has three layers of sheets 114 and two layers of adhesive. This process continues until each of the remaining hoppers 176d - 176h in line has contributed a sheet 114 and until after each remaining forming conveyor 182c - 182d has emitted a wave-like product until the finished wave-like product 128, which has the desired number of layers of sheets and the desired number of adhesive layers, is provided.

Attention is directed to FIGS. 16-18 which illustrate the third preferred embodiment of the method 220 and assembly 222 of forming the spacer 100 of the first embodiment of the invention. The method 220 begins with the step 224 of providing the apparatus 222 which includes a plurality of linerboard rolls 108, a festooning system 228, a die station having a plurality of dies 230, and a cutter (now shown). Each linerboard roll 108 has two tons of continuous paperboard 110 wrapped therearound with the paperboard 110 typically being eighty (80) inches wide and typically heavy-weight kraft linerboard. The linerboard rolls 108 are positioned in a line from the plurality of dies 230 such that each linerboard roll 108 is positioned at a different distance from the festooning system 228 and the plurality of dies 230

than the other linerboard rolls 108. Depending on the desired strength of the spacer 100, there are typically four to ten linerboard rolls 108 provided in the assembly 222. Obviously, the more linerboard rolls 108 which are provided in the assembly 222, the stronger the fabricated spacer 100 will be.

The method 220 may also include the step 232 of conditioning the paperboard 110 from each of the linerboard rolls 108. For example, the paperboard 110 could be steam conditioned.

The method 220 includes the step 234 of pulling the paperboard 110 from each of the linerboard rolls 108 toward the festooning system 228 such that the paperboard 110 from each of the linerboard rolls 108 is layered.

The method 220 includes the step 236 of connecting the layers of paperboard 110 together, preferably with an adhesive, such as glue, to form a laminated product 238. The festooning system 228 applies the adhesive between each of the layers of paperboard 110 in order to connect the layers of paperboard 110 together. The respective layers of paperboard 110 are bonded together to form the laminated product 238. This procedure is generally well-known in the art of forming laminated paper products.

The method 220 includes the step 240 of submitting the laminated product 238 to the plurality of dies 230 to form the wave-like product 128. The laminated product 238 is forced into the plurality of dies 230. The plurality of dies 230, as best illustrated in FIG. 18, collectively fabricate the laminated product 238 having a width of eighty (80) inches into a laminated, bonded paperboard product. The last or latter of the dies 230 in the sequence, molds the pliable laminated product into the form of the wave-like product 128 as illustrated. The wave-like product 128 has a length of approximately forty-eight (48) inches, a width of approximately forty-eight (48) inches, a height of approximately four (4) inches, and a

thickness of approximately one-quarter (0.25) of an inch.

The method 220 then includes the steps 162, 164 of the first preferred embodiment of the method 102 of forming the spacer 100 and, if desired, the steps 166 and 168 and well.

Thus, as illustrated in FIG. 19, the formed spacers 100 preferably comprise a plurality of curved portions 244a, 244b which are connected together such that the curved portions 244a provide a number of peaks and such that the curved portions 244b provide a number of valleys. Thus, the formed spacers 100 appear to be wave-like because of the alternating peaks and valleys formed by the curved portions 244a, 244b. Each spacer 100 also has top and bottom edges 246 (please note that the bottom edge is not shown in FIG. 19, but is positioned on top of the lower lift 252 illustrated in FIG. 20) which expose the various sheets 114 of paperboard 110 and the adhesive which is sandwiched therebetween to secure the sheets 114 of paperboard 110 together. Each spacer 100 also has a pair of outer surfaces 248, 250, which are the only surfaces from the sheets 114 of paperboard 110 which were not adhered to another surface of an adjoining sheet 114 by the adhesive.

An alternative version of the spacer 100 is partially illustrated in FIG. 19a. The alternative version is identical to the spacer 100 illustrated in FIG. 19, except the spacer 100 in FIG. 19a has a generally leg portion 242 provided between each curved portion 244a and each curved portion 244b.

Thus, the spacer 100 has a length L of approximately forty-eight (48) inches, a width W of approximately two and a half (2.5) inches, a height H of approximately four (4) inches, and a thickness T of approximately one-quarter (0.25) of an inch. The width W of the spacer 100 is defined as the distance between one of the edges 246 and the other one of the edges 246 of the spacer 100. The height H of the spacer 100 is defined as the distance between a crest of the curved portion 242a of the spacer 100 and a crest of the curved portion 242b of

the spacer 100. The thickness T of the spacer 100 is defined as the distance between the outer surfaces 248, 250 of the spacer 100.

The spacers 100 are capable of supporting a number of lifts 252 of wallboard 254, as illustrated in FIGS. 20 and 21. In order to support the lifts 252 of wallboard 254, each spacer 100 is positioned on one of its two edges 246, as illustrated in FIG. 20. The spacers 100 are purposely manufactured such that the grain fibers 256 of the paperboard 110 run parallel to one another from one edge 246 of the spacer 100 to the other edge 246 of the spacer 100. With the grain fibers 256 running parallel to one another, the assembly and formation of the spacers 100 is made easier and the spacer 100 gains a compression bonus of forty (40) percent. The spacers 100 are positioned on one of its two edges 246 because the spacers 100 are intentionally formed to use the architectural and inherent strength of the aligned paperboard fibers 256. In this manner, the grain fibers 256 of the spacer 100 are not fighting the curved portions 244 of the spacer 100. Loading the spacer 100 as illustrated in FIG. 20 thus will not distort the wave form with each curved portion 244 of the spacer 100 in effect providing a support column for the lifts 252 of wallboard 254.

Each lift 252 is generally comprised of thirty (30) to thirty-six (36) wallboards 254 which are stacked one on top of the other. Each wallboard 254 in the lift 252 is typically four (4) feet wide by eight (8) feet long and typically weighs between fifty (50) and fifty-five (55) pounds. Thus, one lift 252 may generally weigh anywhere from one-thousand five hundred (1,500) pounds to two-thousand (2,000) pounds. The lift 252 in FIG. 20 is only shown in partial outline and phantom and is broken away to illustrate clearly how the spacer 100 will support the lift 252 in column loading.

As lifts 252 may be stacked ten (10) high in a warehouse, each set of spacers 100, typically four, are fabricated to support fifteen-thousand (15,000) to twenty-thousand (20,000)

pounds in a warehouse environment. As the spacers 100 are fabricated from paper, four paper spacers 100 typically have a compression safety factor of at least four times actual dead weight to account for environmental loss common with a paper product. Paper is hydroscopic and will lose fifty (50) percent of its compression value under high humidity. Thus, four spacers 100 require a safety factor target of sixty-thousand (60,000) to eighty-thousand (80,000) pounds.

The spacers 100 of the present invention provide a number of advantages over the prior art spacers 20, which are typically formed of existing gypsum wallboard.

First of all, using the spacers 100 allows the manufacturers of the wallboard 254 to sell all of the wallboard 254 manufactured, rather than using portions of it to act as spacers 20, as is done in the prior art.

Second, the spacers 100 are easily stackable or nestable on top of one another such that they can be easily transported from the manufacturer for supporting and stacking the lifts 252. Because the spacers 100 are nestable, a minimal amount of space will be lost within the trailers transporting the spacers 100 to the manufacturer and over forty-eight thousand (48,000) spacers100 could be shipped in a typical semi-trailer versus the only approximately forty-five hundred (4,500) spacers 20 which could be shipped in the typical semi-trailer.

Third, the spacers 100, as they are made of paper, are recyclable. Thus, the end user of the wallboard 254, if desired, could recycle the spacers 100 used in the shipment of the wallboard 254 as a possible revenue source, or the manufacturer of the wallboard 254, can have the spacers 100 recycled should they become damaged, or should return and reuse not be economically feasible. This saves money to both the end user and the manufacturer, and helps the environment at the same time as the spacers 100 do not have to be sent to a landfill. Further, if desired, the spacers 100 can be burned or buried. The physical space and physical

weight of spacers 100 buried in a landfill would be approximately 90% less than the physical space and physical weight of prior art slooters 20 buried in a landfill.

Fourth, the spacers 100, as they are made of paper, are not distasteful to retailers because they do not cause a mess and/or safety hazards since they do not produce dust. Thus, they do not require the same cleanup costs as do prior art spacers 20.

Fifth, the spacers 100 lend themselves to being manufactured by automation, whereas the slooters 20 of the prior art did not. Thus, because the slooters 20 of the prior art required labor to gather, saw, laminate, etc. in order to prepare the slooters 20, the use of the spacers 100 basically will eliminated this costly and time consuming labor which is required for the formation of the slooters 20 of the prior art. The spacers 100 are thus, also, very economical in their manufacture.

Sixth, the spacers 100 are provided with a width that provides the spacers 100 with a stackable surface for stacking, for instance, the lifts 252 of wallboard 254. The spacers 100 are configured to stand on their own and have a width and height which lends it to acting as a platform for resting or stacking wallboard 254 thereon. The spacers 100 also have curved walls as opposed to straight walls such that the spacers 100 have an inherent strength from the curved walls.

Finally, the spacers 100 are much lighter than the spacers 20 of the prior art. The spacers 100 typically weigh about one (1) to two (2) pounds a piece such that they are at least about eight (8) to twelve (12) pounds lighter than the slooters 20 of the prior art, which typically weight between nine (9) and thirteen (13) pounds. Thus, because truckloads are limited in weight based on the amount the truck can carry and/or the amount which the truck is allowed to carry on the roads, the lighter spacers 100 allow for an increased number of lifts 252 and wallboards 254 to be carried by the truck in each truckload. The tare weight would

thus be reduced as the spacers 100 would only take up approximately 104 pounds of the tare weight, whereas the prior art slooters 20 would take up approximately 1,040 pounds of the tare weight. Thus, more wallboard 254 could be shipped with each shipment with the spacers 100. Thus, the number of shipments of lifts 252 and wallboards 254 is reduced with the use of spacers 100 as opposed to the spacers 20 of the prior art such that freight costs are reduced as well. Loading and unloading labor costs associated with each truckload will also be reduced as the number of truckloads will be reduced. One person could easily pick up twenty (20) spacers 100 for truck loading or unloading. Further, there is no assembly required for the spacers 100 during truck loading or unloading. The spacers 100 also allow for the placement of the spacers 100 to be automated, whereas the prior art slooters 20 are not conducive to automation.

A second embodiment of the spacer 300 of the present invention is illustrated in FIGS. 25-27. The spacer 300 is formed by the methods 102a, 170a, 220a, which are the same methods 102, 170, 220 as is the spacer 100 of the first embodiment of the present invention, up until the step 164 of cutting the wave-like product 128 into a plurality of spacers 100, which are illustrated in FIGS. 22-24, respectively, although the wave-like product 128 which is formed by the methods 102a, 170a, 220a typically has dimensions of forty-eight (48) inches long by forty-eight (48) inches wide by two (2) inches high, as opposed to the four (4) inches high of the wave-like product 128 formed by the methods 102, 170, 220.

Thus, once the wave-like product 128 is formed from each of the methods 102a, 170a, 220a, the next step 302 is to cut the wave-like product 128 to form extra wide spacers 304 which preferably have the length L of approximately forty-eight (48) inches, a width which is preferably double the width W of the spacer 100, in other words a width of five (5) inches, the height H of approximately two (2) inches, and the thickness T of approximately one-

quarter (0.25) of an inch.

The extra wide spacers 304 would then typically be shipped, such that they would be nestable and stackable.

After shipping, the next step 306 in each method 102a, 170a, 220a would be to then split the extra wide spacers 304 apart, preferably in half, along the width of the extra wide spacers 304 such that a pair of spacer segments 308a, 308b are provided. Similar to the spacers 100 of the first embodiment and as illustrated in FIG. 25, each spacer segment 308a, 308b would preferably have a plurality of curved portions 312a, 312a which are connected to one another such that the curved portions 312a, 312b provide a number of peaks and valleys such that the formed spacer segments 308a, 308b appear wave-like. Each spacer segment 308a, 308b also has a pair of edges 314 which expose the various sheets 114 of paperboard 110 and the adhesive which is sandwiched therebetween to secure the sheets 114 of paperboard 110 together. Each spacer segment 308a, 308b also has a pair of outer surfaces 316, 318, which are the only surfaces from the sheets 114 paperboard 110 which were not adhered. to another surface of an adjoining sheet 114 by the adhesive.

An alternative version of the spacer segments 308a, 308b is partially illustrated in FIG. 25a. The alternative version is identical to the spacer segments 308a, 308b illustrated in FIG. 25, except the spacer segments 308a, 308b in FIG. 25a have generally elongated leg portions 310 provided between each curved portion 312a and each curved portion 312b.

The next step 320 in each method 102a, 170a, 220a would be to then fold one of the spacer segments 308b back on the other spacer segment 308a such that the curved portions 312a of one of the spacer segments 308b would be positioned proximate to the curved portions 312a of the other spacer segment 308a, as illustrated in FIG. 25, and such that the curved portions 312b of each spacer segment 308b would be positioned distally from one

another.

The next step 322 in each method 102a, 170a, 220a would be to then secure the two spacers 308a, 308b together along the curved portions 312a of the respective spacer segments 308a, 308b, from the one edge 314 of the spacer segments 308a, 308b to the other edge 314 of the spacer segments 308a, 308b in order to form the spacer 300 of the second embodiment of the invention. The spacer segments 308a, 308b are preferably secured to one another by an adhesive, such as glue, to form the spacer 300 of the second embodiment of the invention, although other methods of securing the two spacer segments 308a, 308b could be utilized, for instance by stapling.

Thus, the spacer 300 preferably has a length L of approximately forty-eight (48) inches, a width W of approximately two and a half (2.5) inches, a height H of approximately four (4) inches, and each spacer segment 308a, 308b has a thickness T of approximately one-quarter (0.25) of an inch. The width W of the spacer 300 is defined as the distance between one of the edges 314 and the other one of the edges 314 of the spacer 300. The height H of the spacer 300 is defined as the distance between a crest of the curved portion 312b of the spacer segment 308a and a crest of the curved portion 312b of the spacer segment 308b. The thickness T of the spacer 300 is defined as the distance between the outer surfaces 316, 318 of each spacer segment 308a, 308b of the spacer 300.

It should be noted that, alternatively, the spacer 300 could be formed by placing two of the spacers 100 of the first embodiment of the invention next to each other such that the curved portions 244a of each spacer 100 face each other. Preferably the spacer 300 would be secured by adhering the curved portions 244a of one of the spacers 100 to the curved portions 244a of the other spacer 100, although other manners of securing the spacers 100 together could also be utilized, for instance by stapling.

The spacer 300 provides for all of the advantages which the spacer 100 provides, but also provides the advantage that the lifts 252 and wallboards 254 are in contact with more surface area of the spacer 300 than with the spacer 100, thus providing the lifts 252 and wallboards 254 with more stability.

It should be noted that the steps of the methods 102, 170, 220, 102a, 170a, 220a could be performed in different sequences where allowed. It should be noted that other methods and apparatus may be used to form the spacers 100, 300, 400 or modified variations thereof, without departing from the spirit and scope of the invention. It should further be noted that all dimensions and weights used in the description of the invention are preferred dimensions and weights, such that they could be altered as desired.

While preferred embodiments of the invention are shown and described, it is envisioned that those skilled in the art may devise various modifications without departing from the spirit and scope of the foregoing description.